

Worksheet 3 Binary arithmetic Task 1

Carry out the following binary sums showing your working out:

a) $101_2 + 111_2$

1	0	1
1	1	1

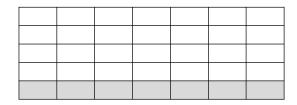
b) $10110_2 + 10111_2$

1	0	1	1	0
1	0	1	1	1

c) $11_2 + 100001_2 + 101_2$

				1	1
1	0	0	0	0	1
			1	0	1

d) $10101_2 + 111011_2 + 1001_2$

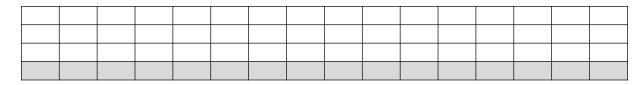


Show how the following values can be stored as binary bytes within a computer system and determine the answer that would be calculated and stored:

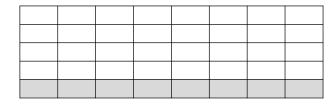
e) $12_{10} + 13_{10}$

12 _ 8	64	32	16	8	4	2	1

f) $174_{10} + 255_{10}$



g) $19_{10} + 66_{10} + 74_{10}$



Answer the following question:

h) A computer has been designed to work only in single bytes of data. Describe the problem that will be encountered when carrying out the sum $01111001_2 + 11111001_2$ if the answer is only allocated one byte of storage.

Task 2 Binary subtraction

Convert these decimal values into two's complement binary bytes:

- a) -50_{10}
- b) -120_{10}
- c) 127_{10}
- d) -128_{10}
- e) Show that -50_{10} gives the same result as in (a) above using the following alternative method:

Assume the left-most bit represents -128. Start at -128 and then add the remaining values:

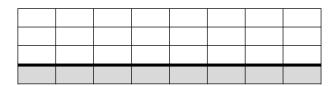
- 128	64	32	16	8	4	2	1

Carry out the following calculations in two's complement binary bytes:

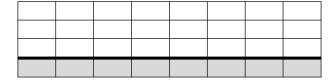
f) $-50_{10}-30_{10}$ or $-50_{10}+-30_{10}$

1	1	0	0	1	1	1	0
1	1	1	0	0	0	1	0

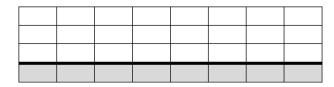
g) $-66_{10} + 34_{10}$



h) -88₁₀ - 12₁₀



i) $22_{10} - -14_{10}$





Task 3 Fixed point binary

Convert these decimal values into a fixed-point binary byte where the first 4 bits represent the whole number part and the last 4 bits represent the fractional part:

- a) 8.5_{10}
- b) 14.25₁₀
- c) 0.125_{10}
- d) 5.5625₁₀
- e) 1.9375₁₀
- f) 0.0625₁₀

Convert these fixed-point binary bytes to decimal where the first 3 bits represent the whole number part and the the last 5 bits represent the fractional part:

- g) 10101010₂
- h) 10111011₂
- i) 00111011₂
- j) 11111000₂
- k) 00011111₂
- l) 11111111₂